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Practice-Based Learning: Opportunities and Implications for STEM Education

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Practice-Based Learning: Opportunities and Implications for STEM Education

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PUBLIC HEALTH | SERVICES & SYSTEMS RESEARCH PRACTICE-BASED RESEARCH NETWORKS
National Coordinating Center

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Center for Public Health Systems and Services Research

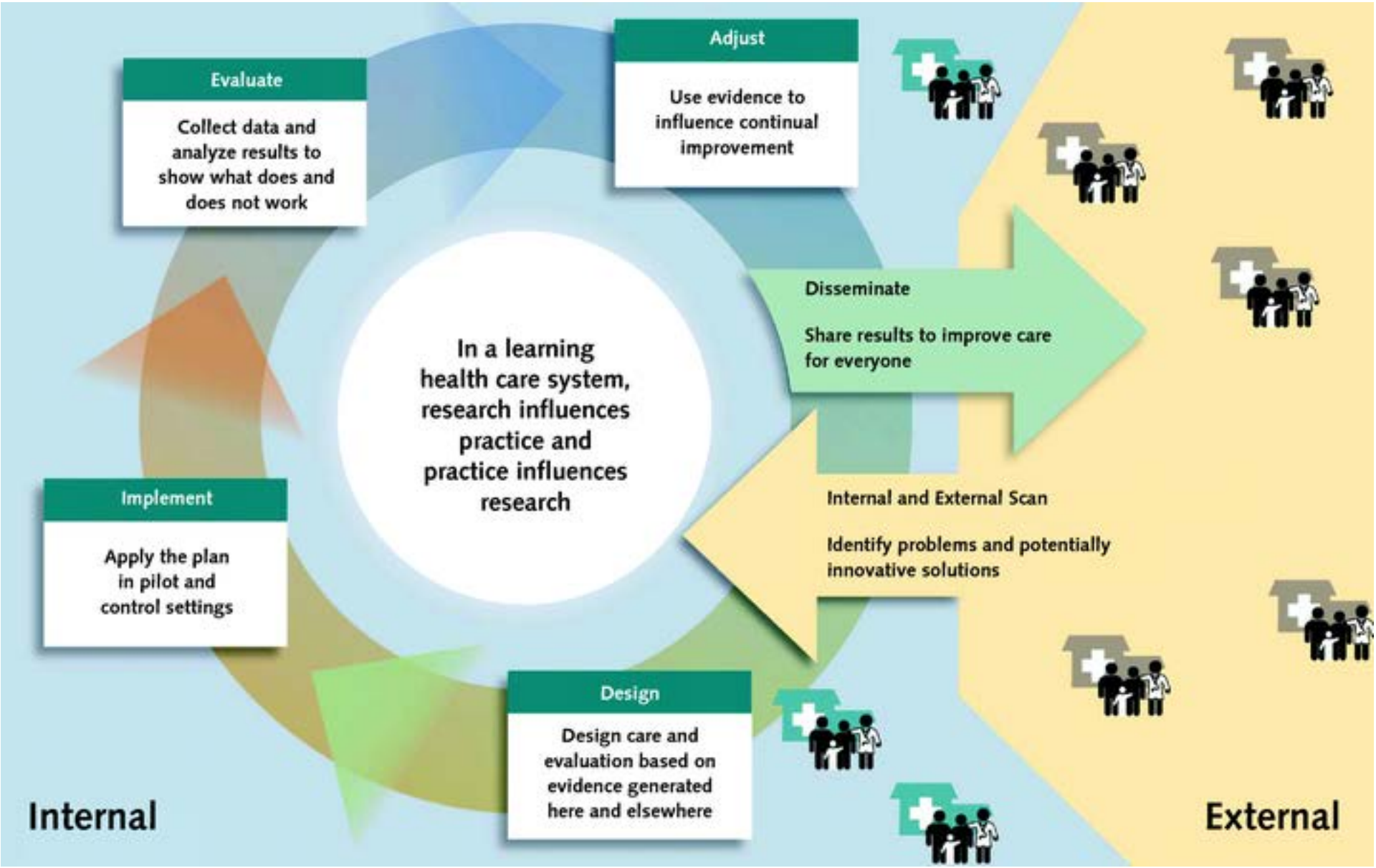
Overview

- What is practice-based learning and research?
- Why do we use it in public health?
- PBR roles in knowledge acquisition & dissemination
- Implications & opportunities for STEM education

What is Practice-Based Research?

- Designed to address uncertainties and information needs of real-world ***decision-makers***
- Engages practitioners in the ***scientific process***: conceptualization → translation
- Tests effectiveness & impact of interventions in real-world ***practice settings***
- Evaluates the implementation and impact of ***innovations in practice***
- Uses ***observations generated through routine practice*** to produce knowledge

PBR and “rapid-learning systems”



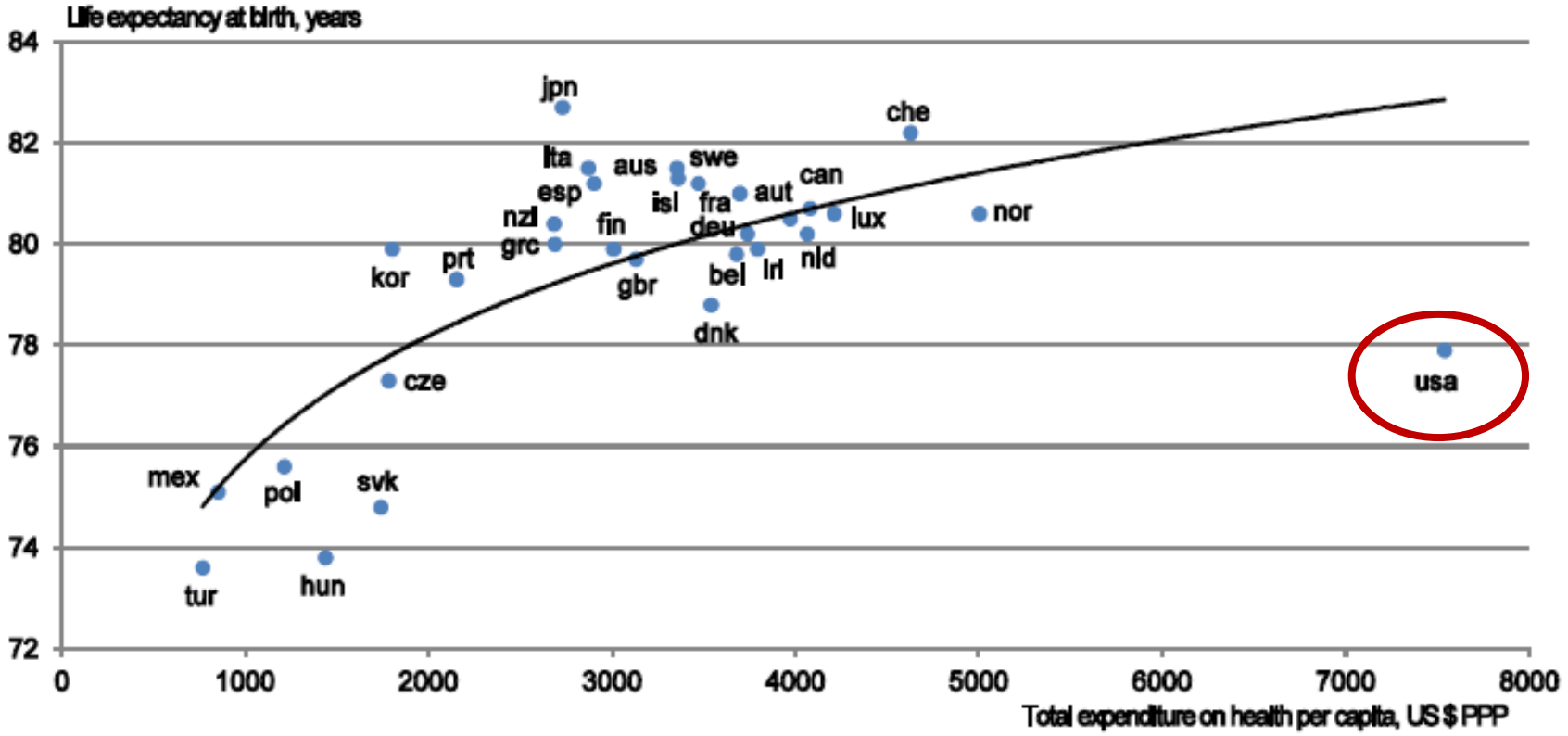
Green SM et al. *Ann Intern Med*. 2012;157(3):207-210

Key targets of PBR

- Diffusion and implementation of evidence-based practices
  - Under-use
  - Over-use
  - Mis-use
- Fidelity vs. adaptation
- Targeting & tailoring

Failures in public health practice

Figure 1. **There are large differences in life expectancy and health care spending across OECD countries 2008**[1]

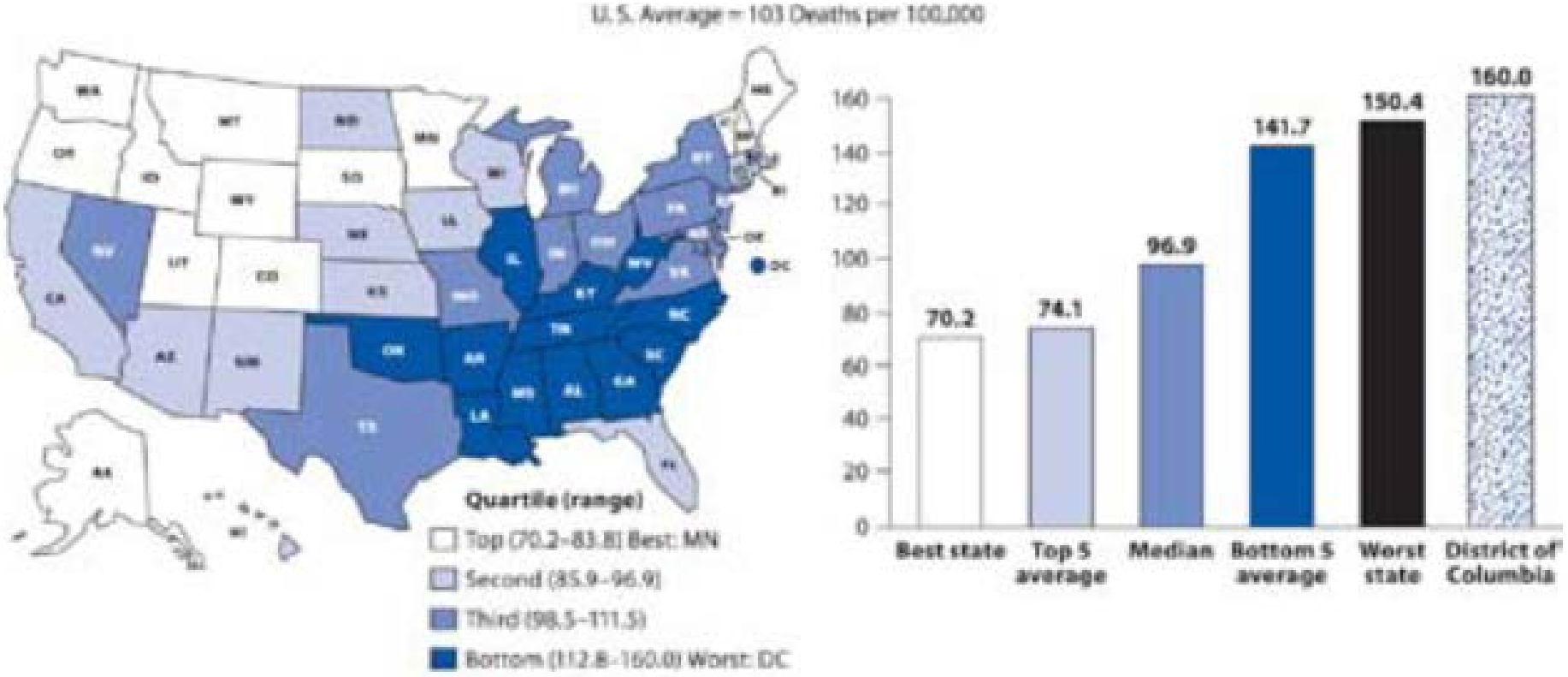


1. Or latest year available.

Source: OECD Health Data 2010.

Failures in public health practice

Premature Deaths per 100,000 Residents



Commonwealth Fund 2012

Failures in public health practice

Less than 50% of the U.S. population at risk is reached by evidence-based public health practices:

- Smoking cessation
- Influenza vaccination
- Hypertension control
- Nutrition and physical activity programming
- HIV prevention
- Family planning
- Substance abuse prevention
- Interpersonal violence prevention
- Maternal and infant home visiting for high-risk populations

Public health services & systems research

A field of inquiry examining the ***organization***, ***financing***, and ***delivery*** of public health services at local, state and national levels, and the ***impact*** of these activities on ***population health***

Strategies to promote health and prevent disease & injury on a population-wide basis: programs, policies, administrative practices

Mays, Halverson, and Scutchfield. 2003

A Key PHSSR Goal: Optimization

How to optimally deploy a diverse collection of responsibilities, resources, actors & expectations?

- Epidemiologic **surveillance & investigation**
- Community health **assessment & planning**
- Communicable disease control
- Chronic disease and injury prevention
- Health education and communication
- Environmental health **monitoring and assessment**
- Enforcement of health **laws and regulations**
- Inspection and licensing
- **Inform, advise, and assist** school-based, worksite-based, and community-based health programming

…and roles in **assuring access** to medical care

Standardization vs. Customization in public health delivery systems

Standardization

- ▼Harmful variation
- ▼Wasteful variation
- ▼Inequitable variation
- ▼Race to the bottom
- ▲Network externalities: interoperability/coordination

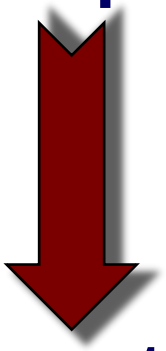
Customization

- ▲Target resources to greatest needs/risks
- ▲ Tailor approaches to values & preferences of stakeholders
- ▲ Deploy unique resources & skills to their best purposes

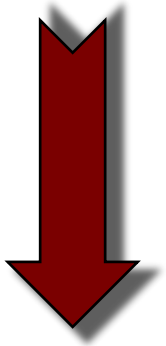
Developmental path for PBR: learning from variation

- Measuring practice & performance
- Detecting variation in practice
- Examining determinants of variation
  - Organization
  - Financing
  - Workforce
  - Law & policy
  - Information
  - Preference
- Determining consequences of variation
  - Health outcomes
  - Economic outcomes
  - Medical care use
  - Disparities
- Testing strategies to reduce **harmful**, **wasteful**, & **inequitable** variation in practice and outcomes

Descriptive

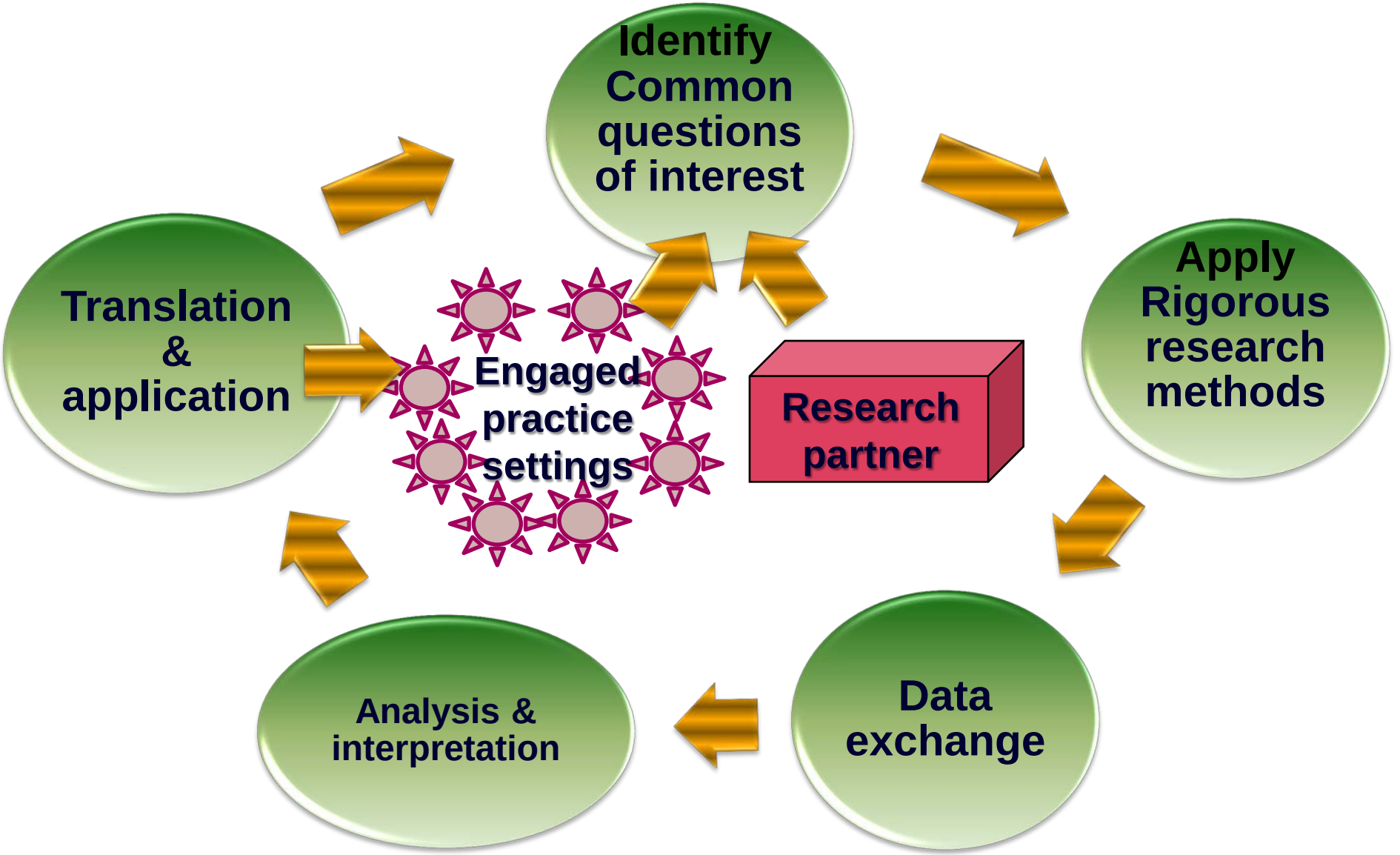


Inferential

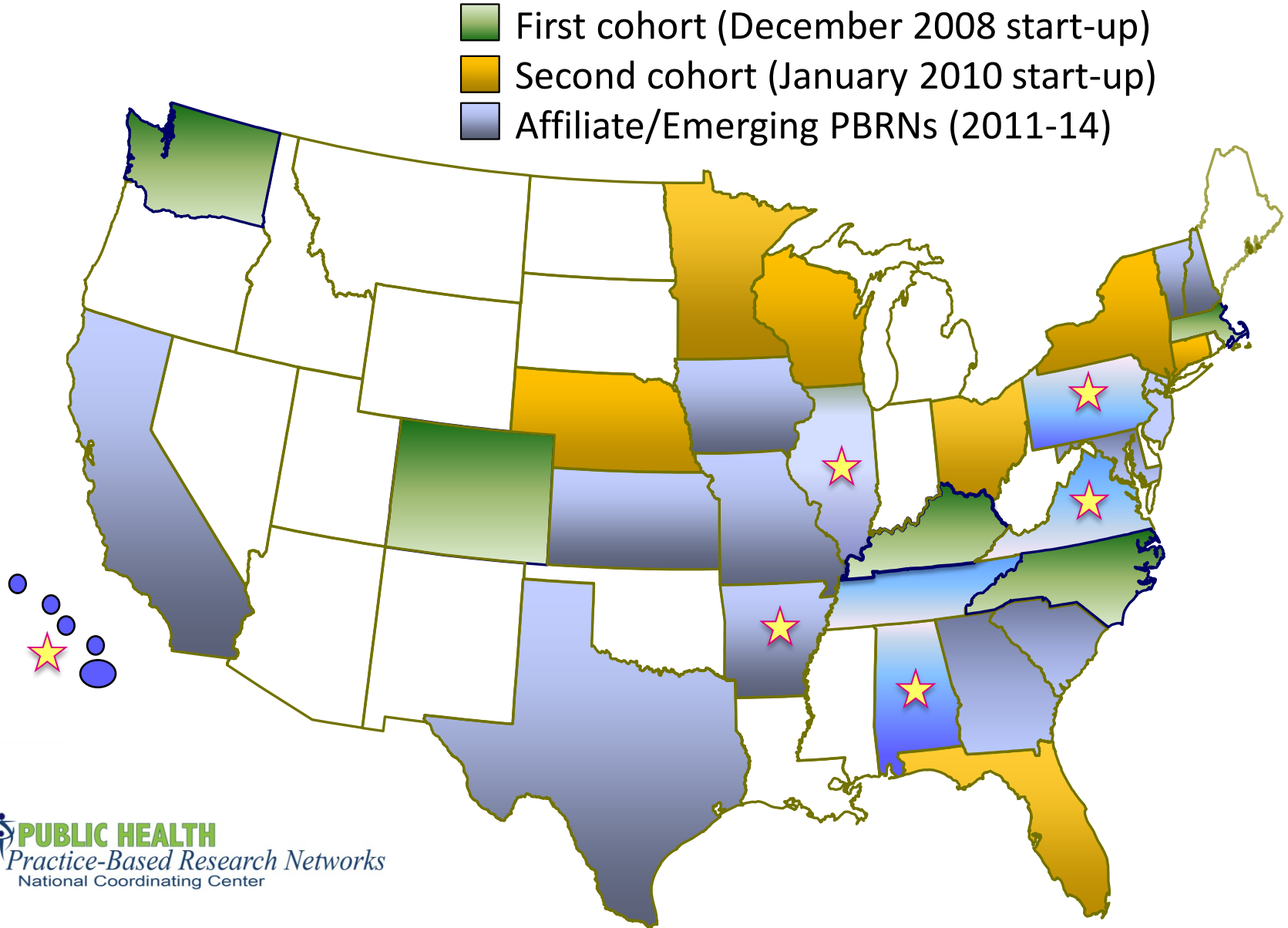


Translational

The Logic of Practice Based Research Networks



Diffusion of Public Health PBRNs



PUBLIC HEALTH
Practice-Based Research Networks
National Coordinating Center

PBRNs as Research Engines

- 31 networks
- 1593 local public health agencies
- 35 state agencies
- 52 academic research units
- 58 professional & community organizations
- 60 competitively awarded research projects
- 82 articles in peer-reviewed journals
- 221 presentations and conferences & meetings
- 51 reports & tools in the grey literature
- >15,000 downloads of *Frontiers in PHSSR* articles
- >8,000 downloads from Research Archive
- >2,000 page views on PublicHealthEconomics blog

PBRNs and Practice Engagement

PUBLIC HEALTH Practice-Based Research Networks
National Coordinating Center

Local Health Departments Engaged in Research Implementation & Translation Activities During Past 12 months

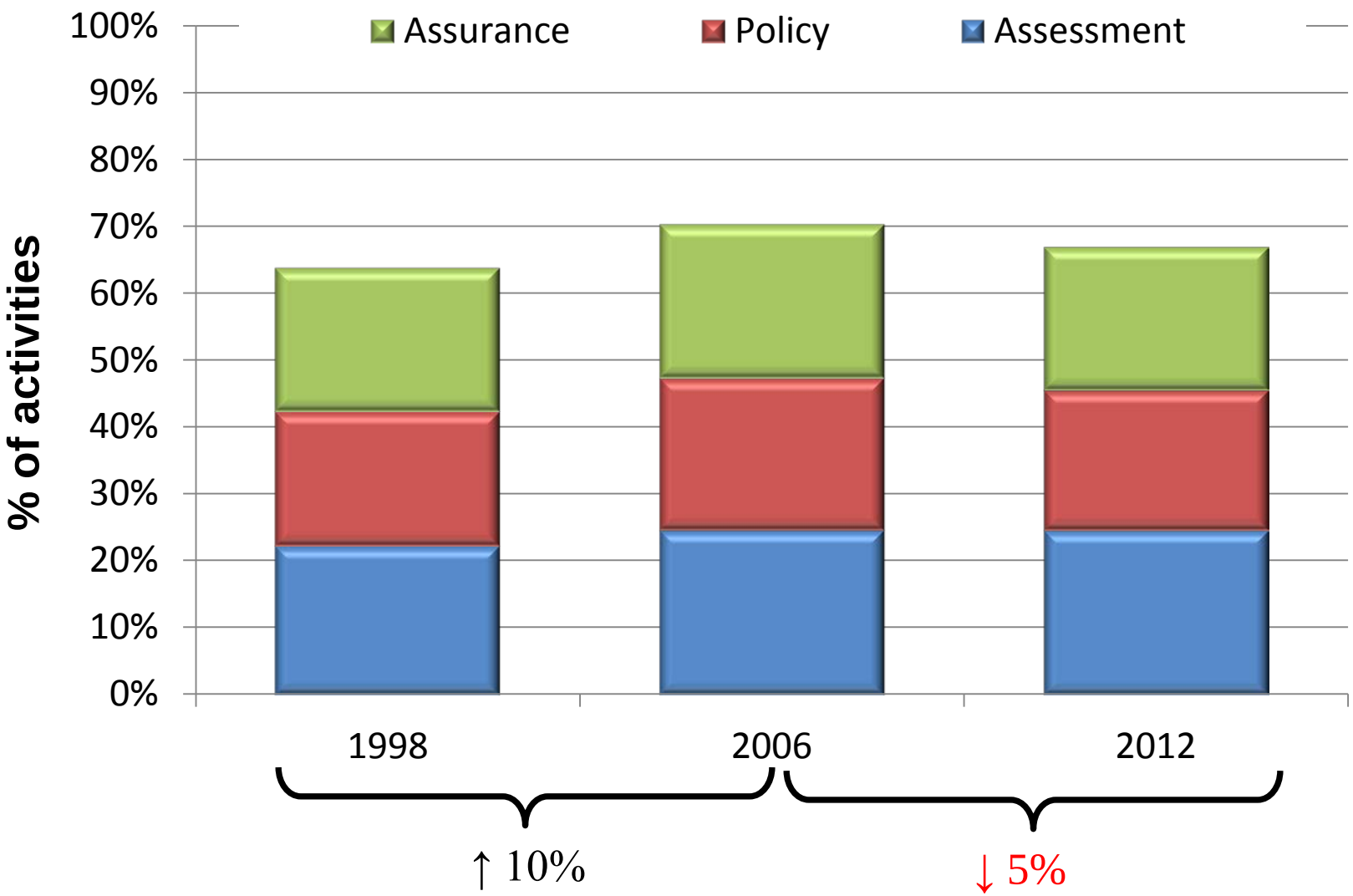
Activity	PBRN Agencies Percent/Mean		National Sample Percent/Mean		
Identifying research topics	94.1%		27.5%		***
Planning/designing studies	81.6%		15.8%		***
Recruitment, data collection & analysis	79.6%		50.3%		**
Disseminating study results	84.5%		36.6%		**
Applying findings in own organization	87.4%		32.1%		**
Helping others apply findings	76.5%		18.0%		***
Research implementation composite	84.04	(27.38)	30.20	(31.38)	**
N	209		505		

Mays et al. 2013

Examples of PBR Learning & Research in Public Health

- Observational, comparative studies
- Natural experiments
- Modeling and simulation
- Pragmatic prospective trials

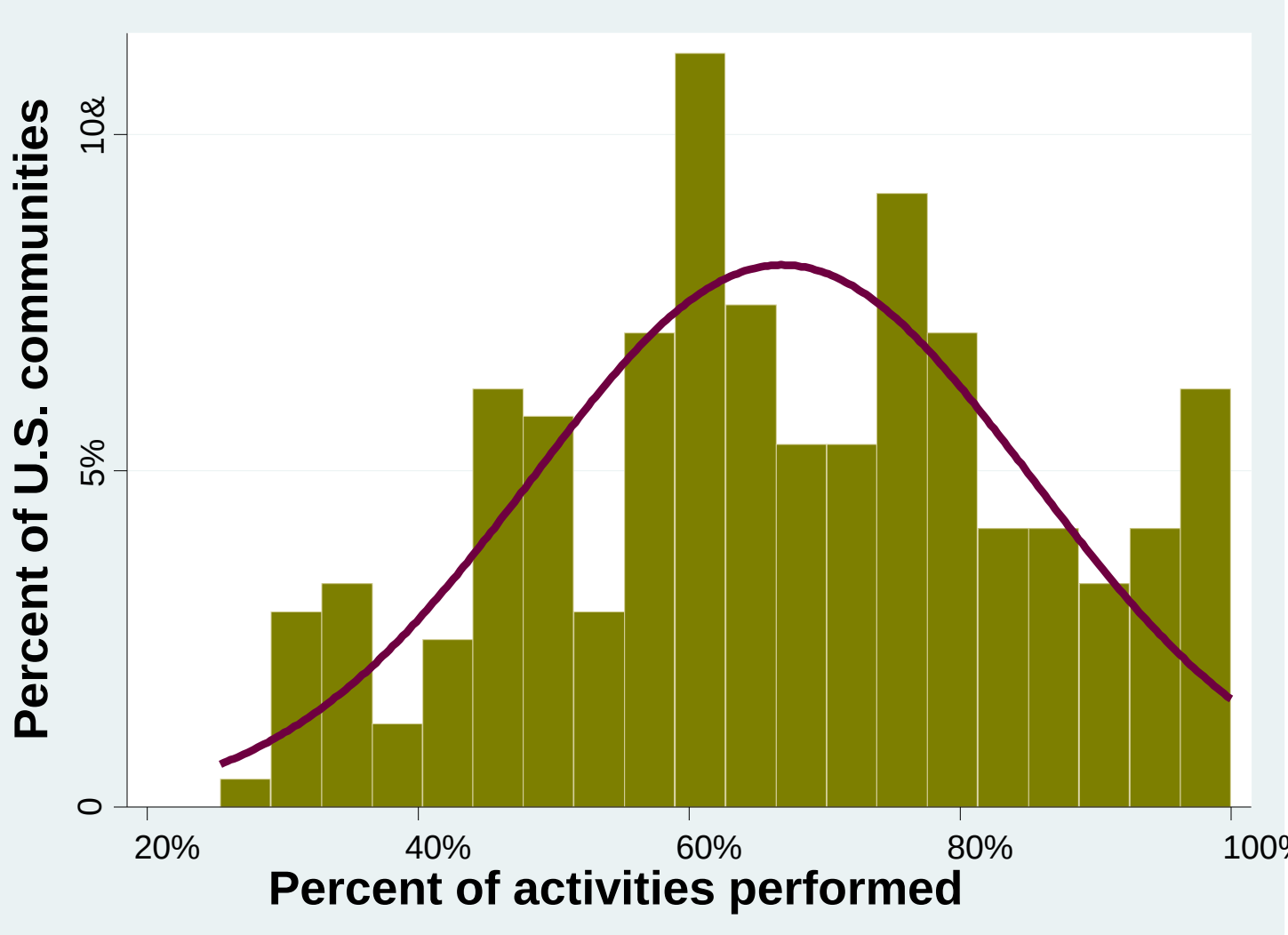
Delivery of recommended public health activities



National Longitudinal Survey of Public Health Systems, 2012

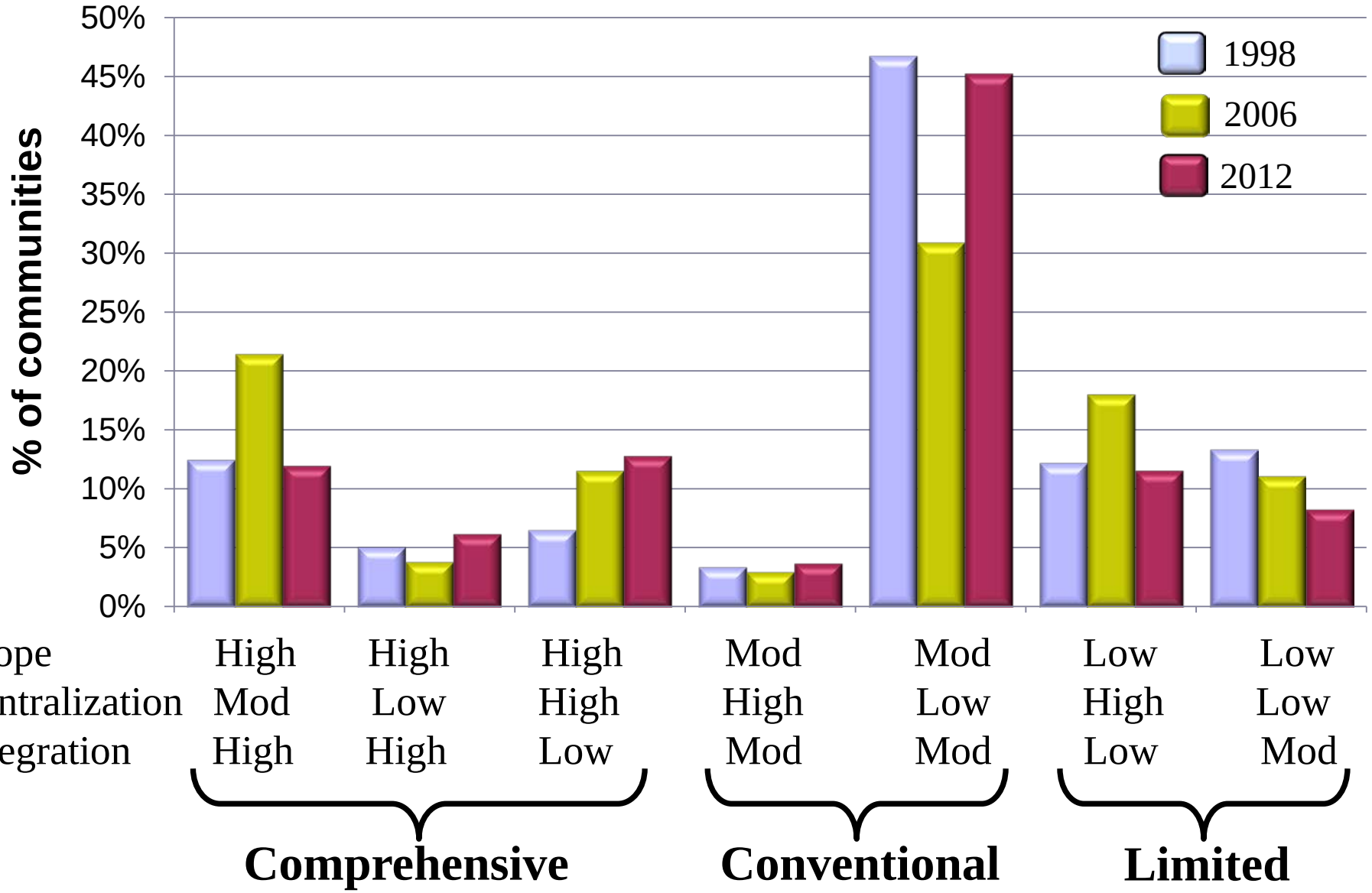
Variation in Scope of Public Health Delivery

Delivery of recommended public health activities, 2012



National Longitudinal Survey of Public Health Systems, 2012

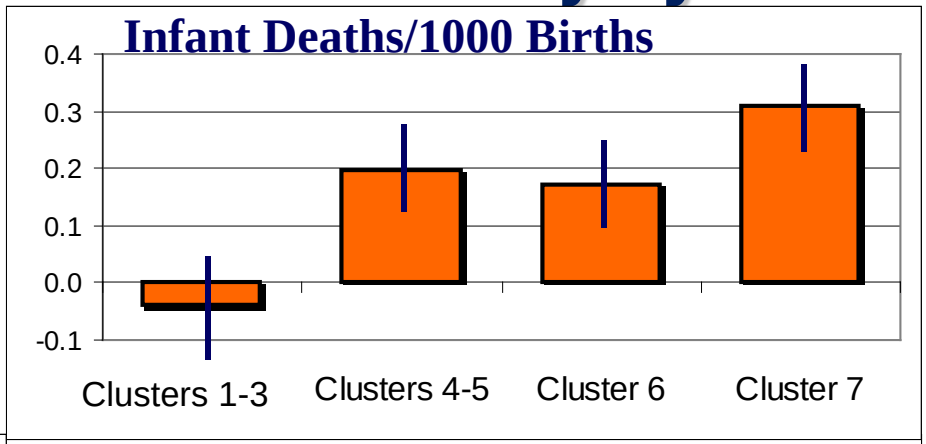
A typology of public health delivery systems

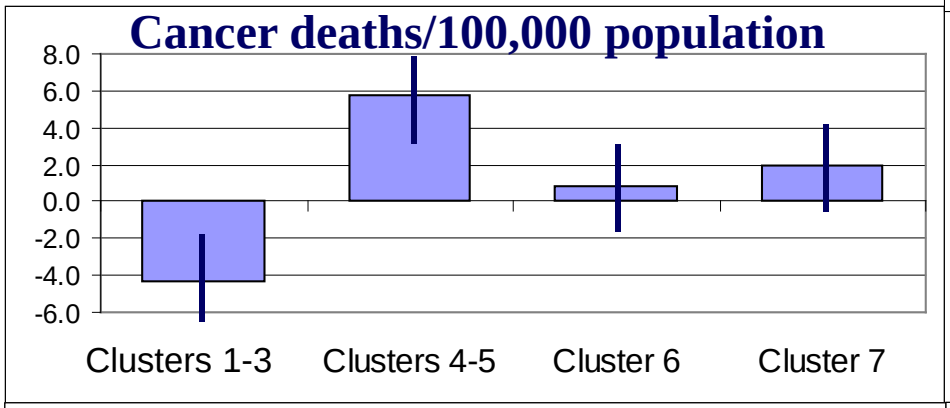


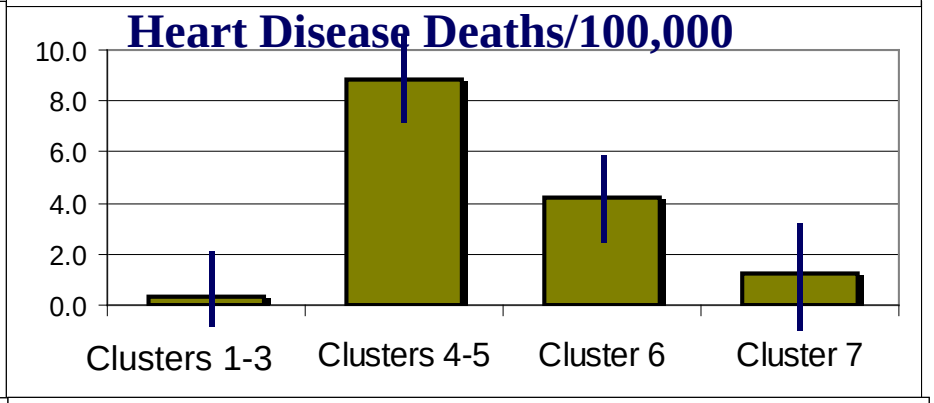
Source: Mays et al. 2010; 2012

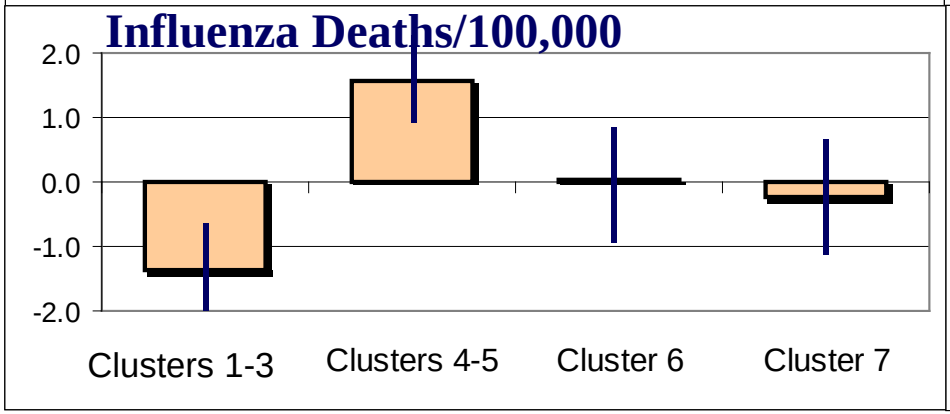
Changes in health associated with delivery system

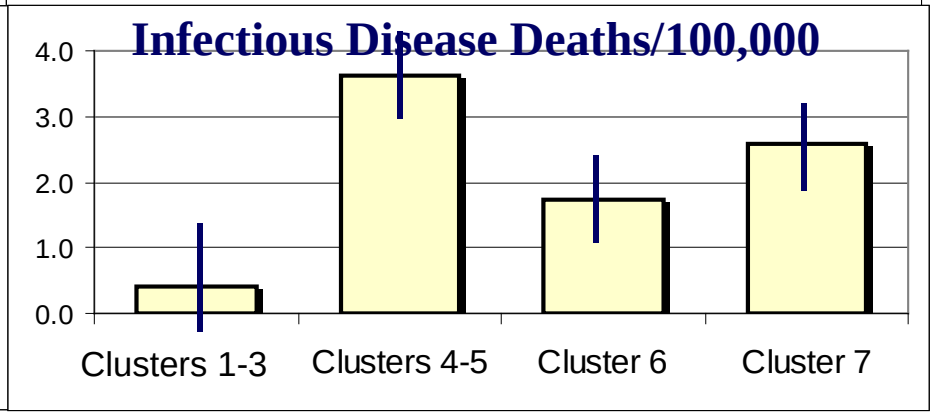
Percent Changes in Preventable Mortality Rates by System Typology (cluster)





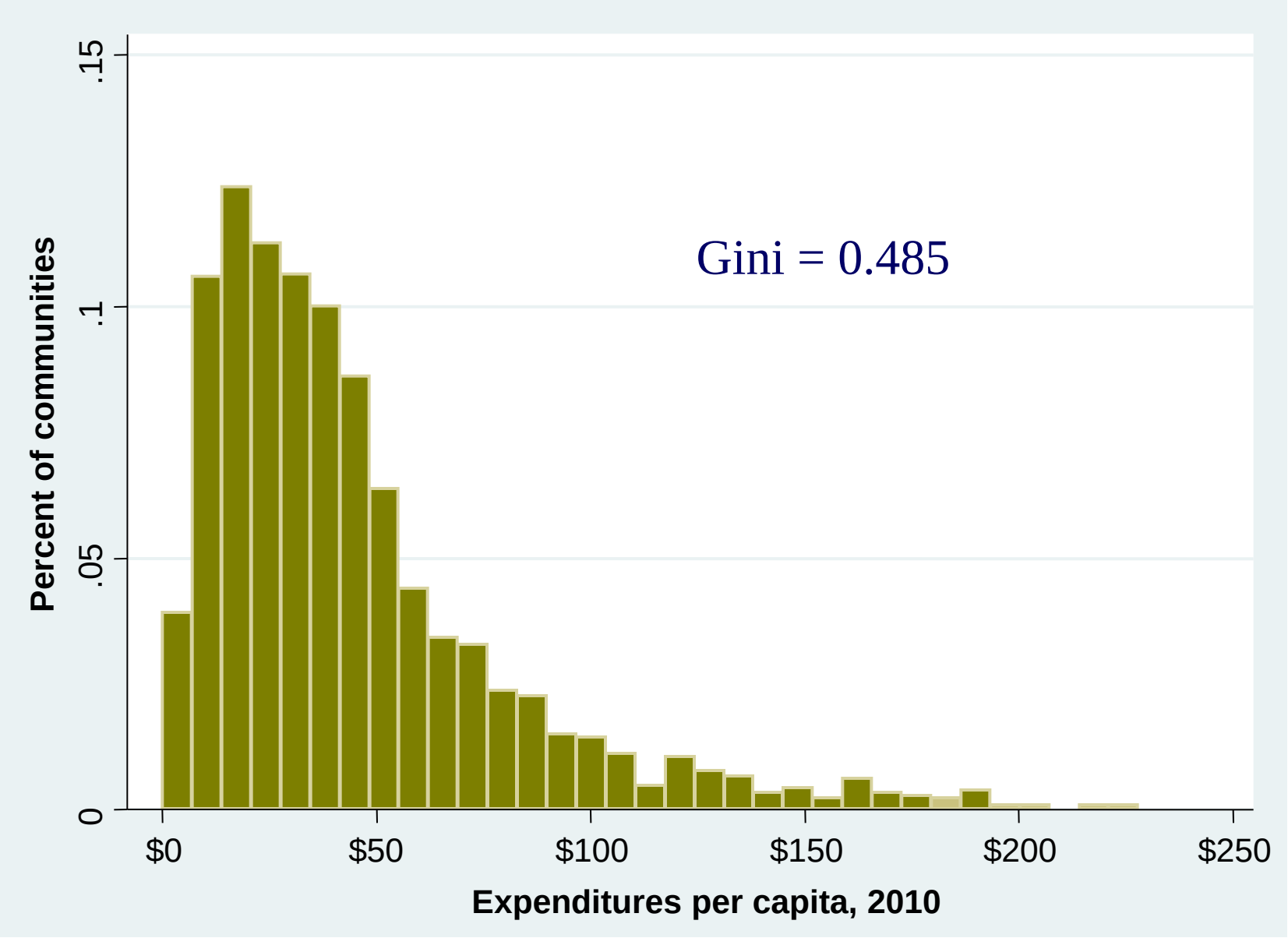




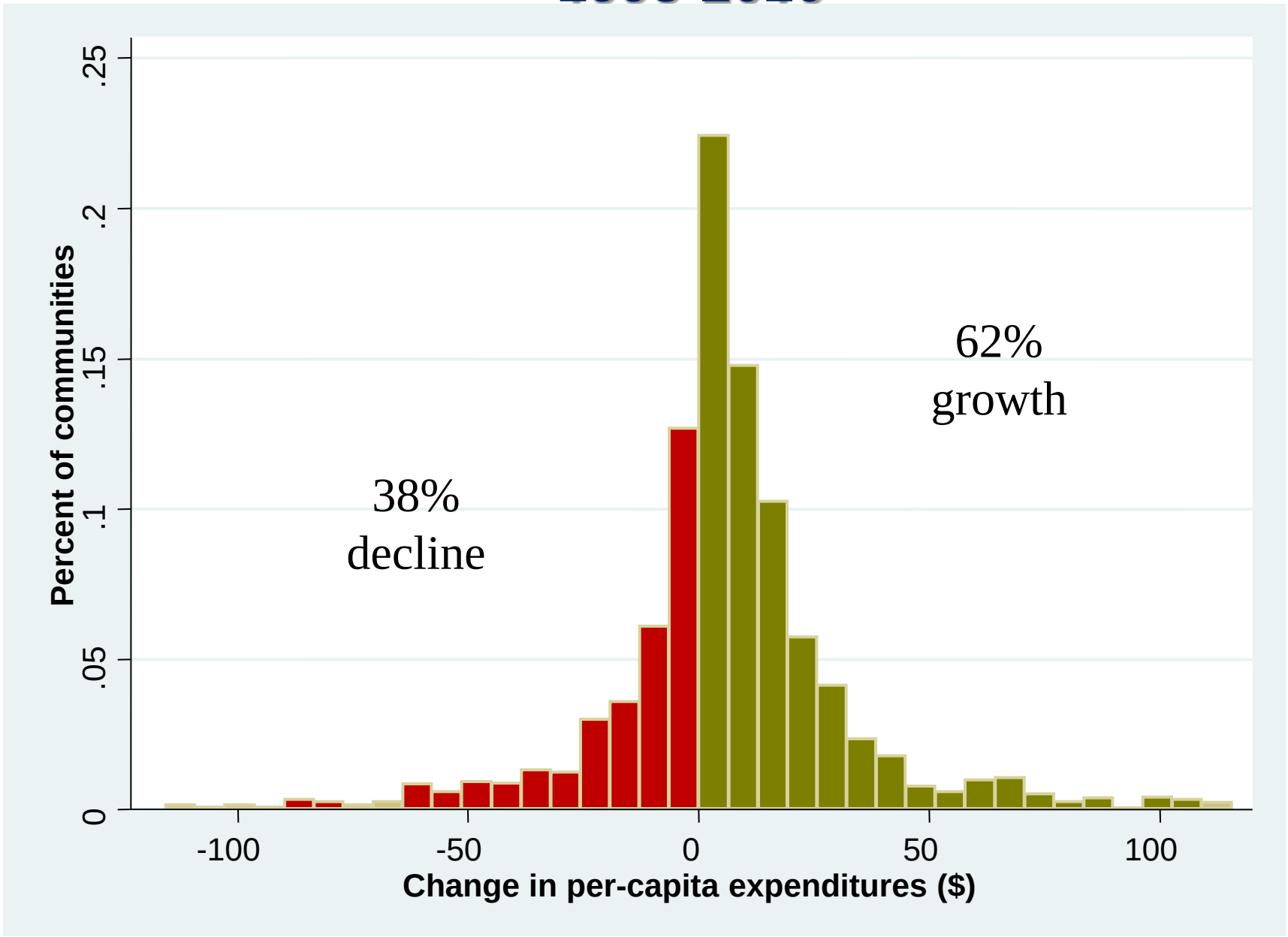


Fixed-effects models control for population size, density, age composition, poverty status, racial composition, and physician supply

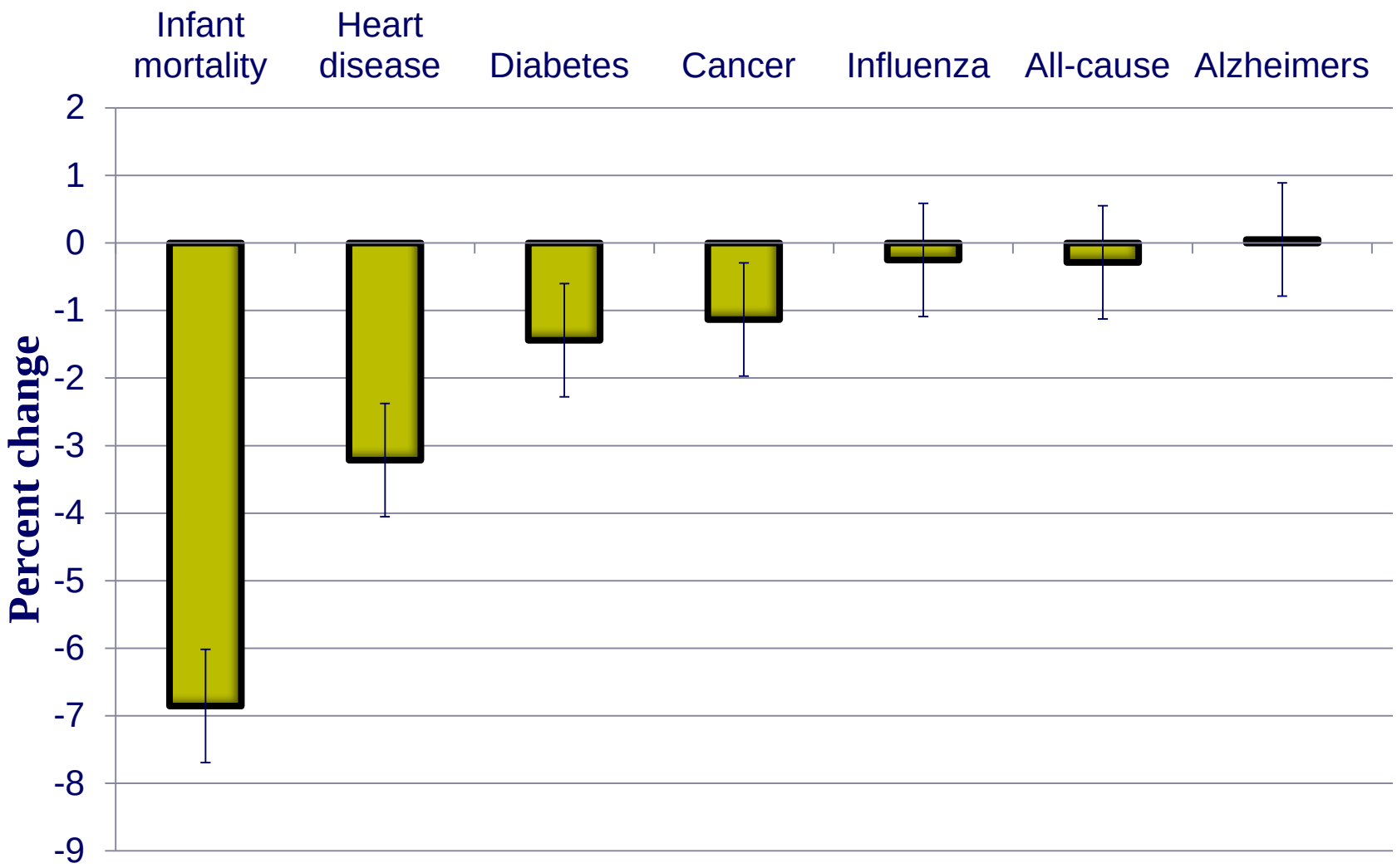
Variation in Local Public Health Spending



Changes in Local Public Health Spending 1993-2010



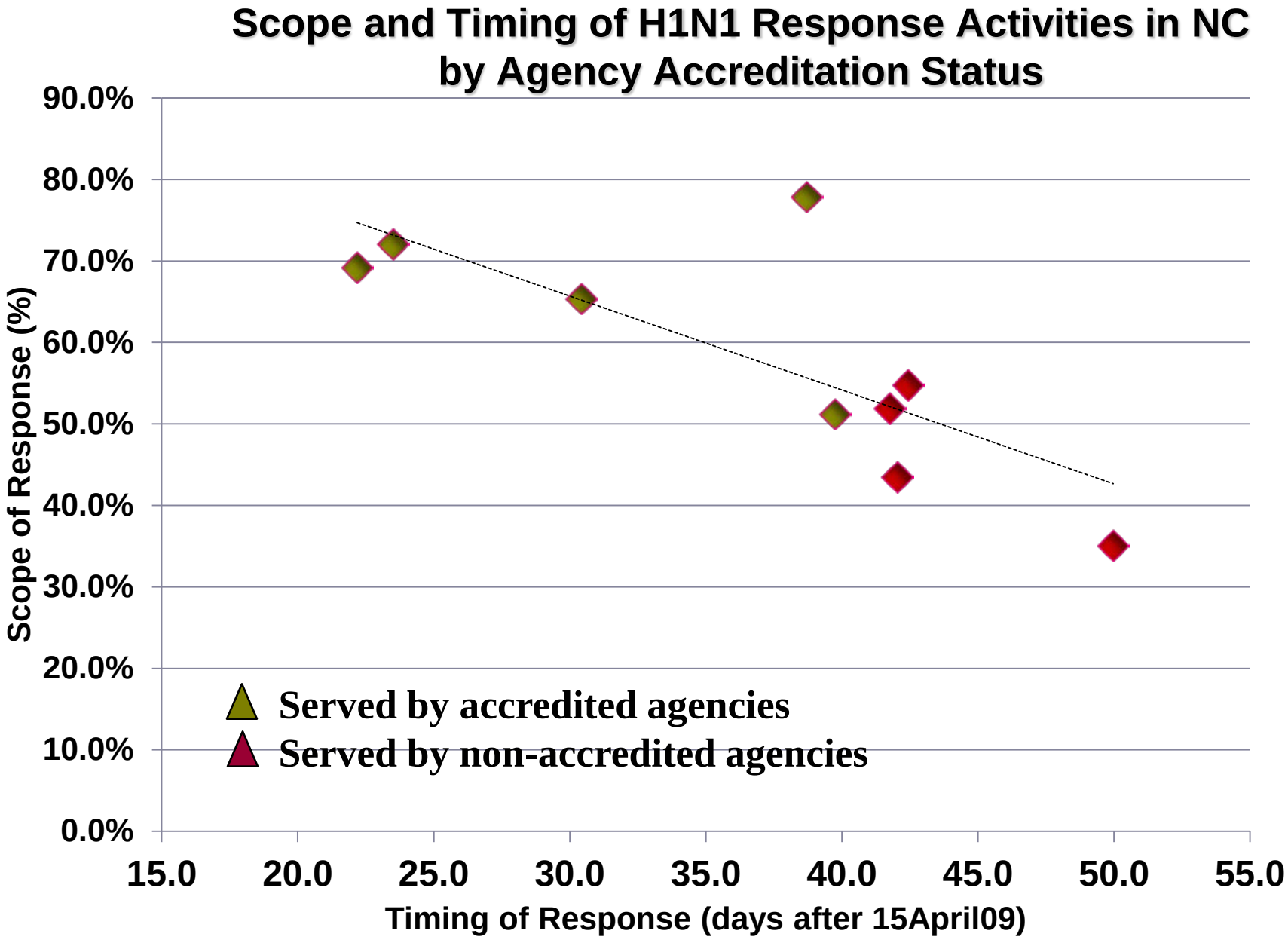
Mortality reductions attributable to local public health spending, 1993-2008



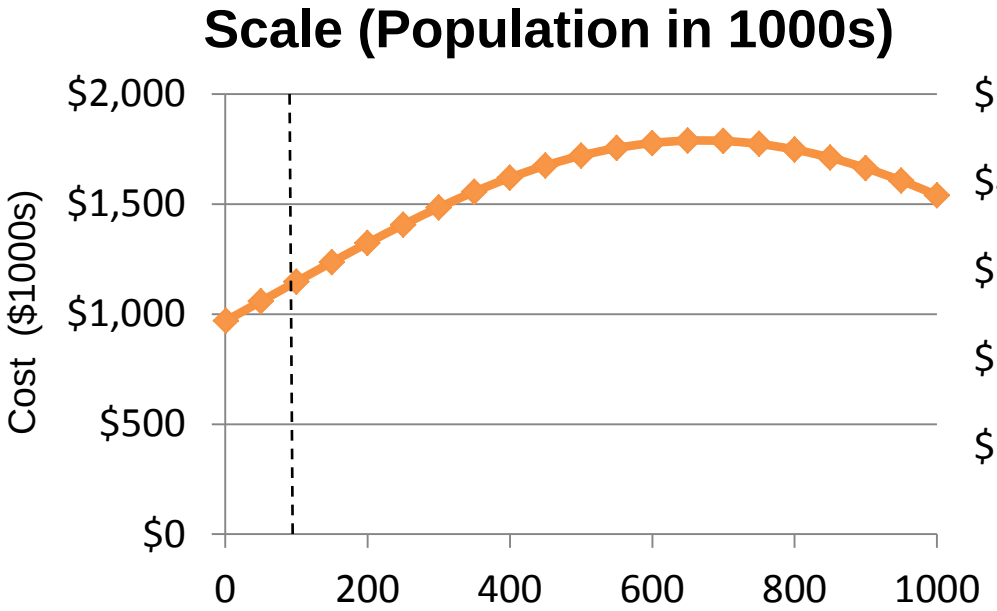
Hierarchical regression estimates with instrumental variables to correct for selection and unmeasured confounding

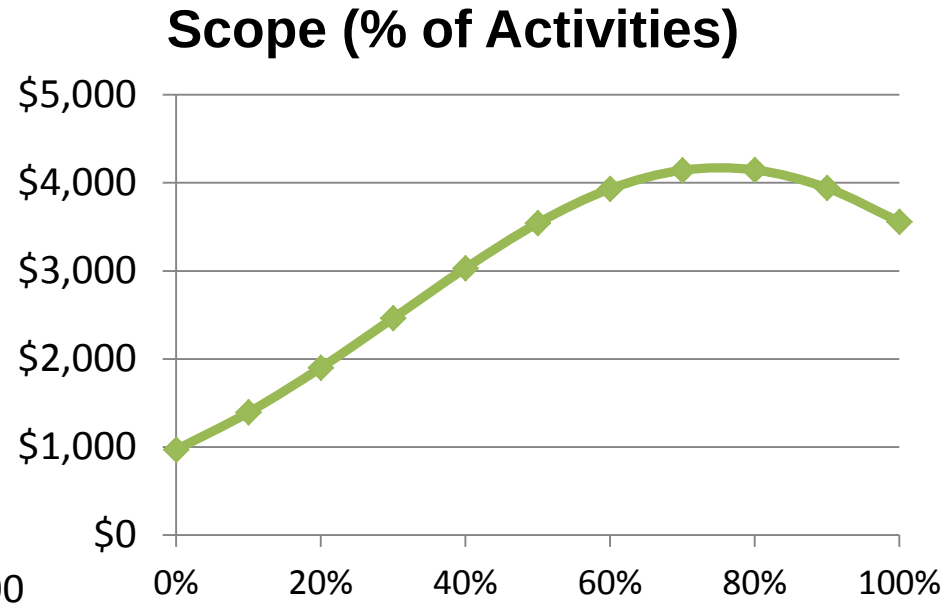
Mays et al. 2011

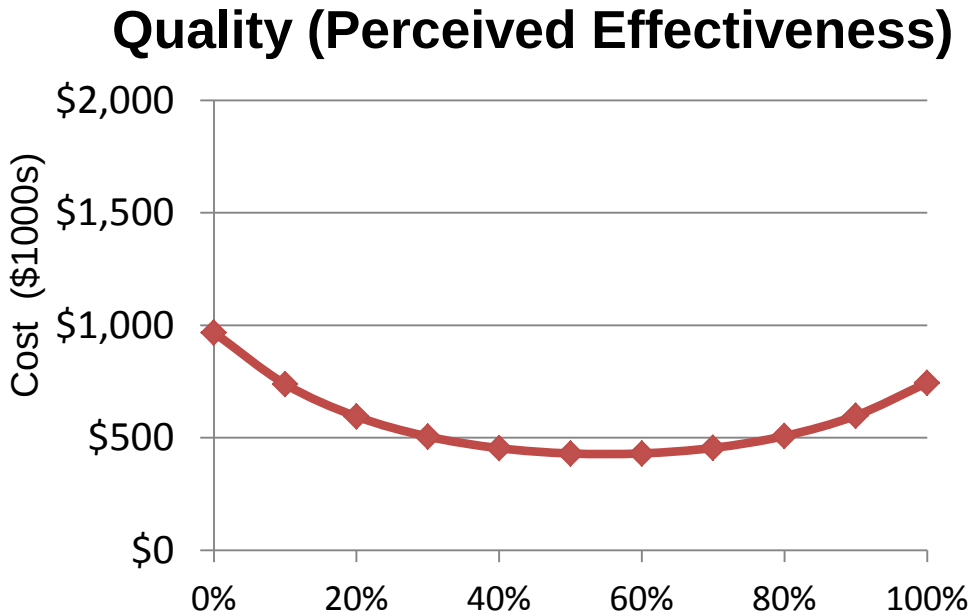
Variation in Public Health Response Capability



Economies of scale and scope in public health delivery

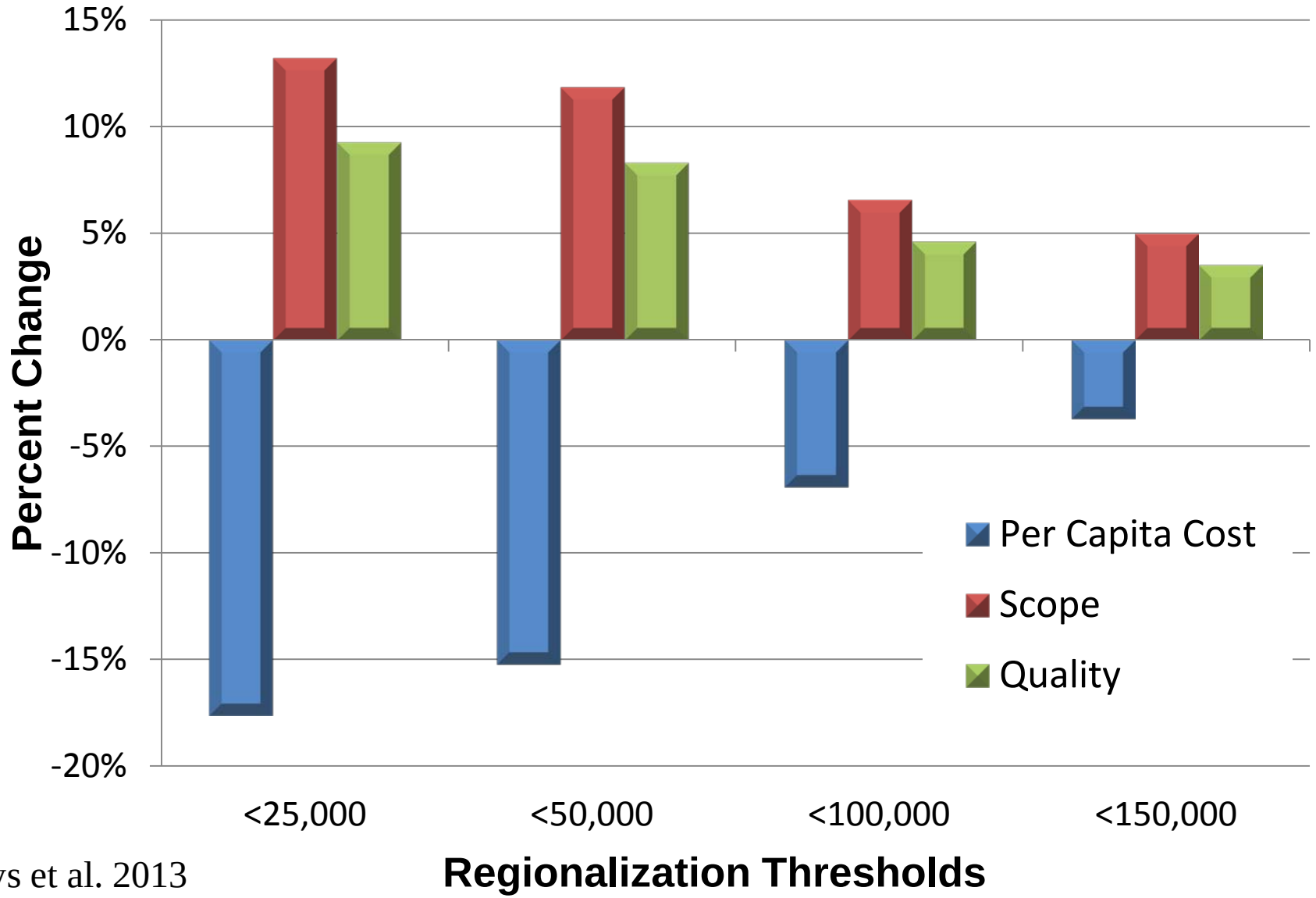






Mays et al. 2013

Gains from regionalizing public health delivery



Mays et al. 2013

Examples: Practice Standards in Ohio

Analyzing Concordance between Position Descriptions and Practice Standards for Public Health Nurses

- ***Question of interest:*** Are positions consistent with national competency standards and scope of practice policies?
- ***Practice settings:*** 125 local health departments in Ohio
- ***Factors examined:***
  - Geographic variation in concordance
  - Organizational, economic, and community characteristics associated with concordance

- ***Study design:*** observational practice variation study, mixed-method

Examples: Cultural Competency in Kentucky

Improving Cultural Competency of Public Health Workers

- ***Question of interest:*** Can a health professions cultural competency training program be adapted to improve skills among local public health workers?
- ***Practice settings:*** 56 local agencies
- ***Factors examined:***
  - Knowledge and skills related to CLAS standards
  - RE-AIM measures of success

- ***Study design:*** random-assignment delayed intervention trial

Examples: Workforce Diversity in Washington

Evaluation of a QI Process to Improve Workforce Diversity

- ***Question of interest:*** Can a QI process be implemented to improve recruitment and retention of public health workers from under-represented racial/ethnic backgrounds?
- ***Practice settings:*** Seattle-King County
- ***Factors examined:***
  - Recruitment
  - Hiring process
  - Retention

- ***Study design:*** pre-post study with comparison group

Examples: Studying Public Health Production

Multi-Network Practice and Outcome Variation (MPROVE) Study, 2012-14

Measures Collected Consistently Across 6 PBRNs

- ***Availability/Scope:*** specific activities produced
- ***Volume/Intensity:*** Frequency of producing activity over period of time
- ***Capacity:*** Labor and capital inputs assigned to an activity
- ***Reach:*** Proportion of target population reached by activity
- ***Quality:*** effectiveness, timeliness, equity of activity
- ***Efficiency:*** resources required to produce given volume of activity

MPROVE Benchmarking and peer comparisons

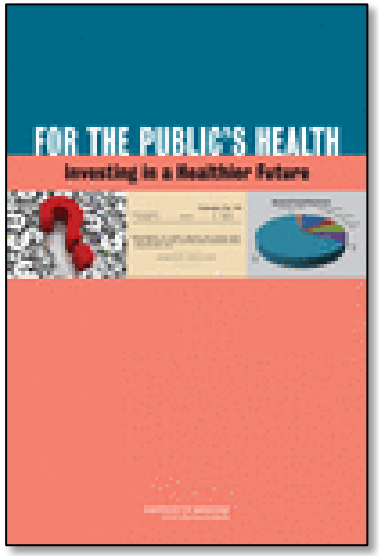
Table 2: Local Health Department Performance of Tobacco Prevention, Control, and Cessation Activities

Activity	Your Agency	State-specific Averages						Six-State Average
		CO	FL	MN	NJ	TN	WA	
1 Educational materials	Yes	88.7%	89.4%	76.0%	80.9%	-	88.9%	84.1%
2 Educational media	No	54.7%	66.0%	42.0%	17.6%	-	29.6%	41.2%
3 Cultural/linguistic specific materials	No	58.5%	61.7%	26.0%	41.2%	-	33.3%	44.9%
4 Cultural/linguistic specific programs	No	41.5%	44.7%	8.0%	16.2%	-	11.1%	24.9%
5 Educational/training programs	Yes	58.5%	80.9%	50.0%	38.2%	-	29.6%	52.2%
6 Community development	No	35.8%	80.9%	50.0%	41.2%	-	55.6%	51.0%
7 Policy development	No	43.4%	78.7%	58.0%	47.1%	-	44.4%	54.3%
8 Tobacco cessation programs	Yes	0.0%	0.0%	82.0%	11.8%	-	0.0%	20.0%
9 Adult tobacco use surveillance	No	0.0%	31.9%	0.0%	8.8%	-	18.5%	10.6%
10 Youth tobacco use surveillance	Yes	0.0%	57.4%	0.0%	13.2%	-	29.6%	18.0%
Any activity	Yes	64.5%	67.2%	96.2%	87.0%	-	74.3%	76.9%
All activities	No	0.0%	4.5%	0.0%	1.4%	-	2.9%	1.7%
Average number of activities	4.0	3.0	4.4	3.8	3.6	-	3.0	3.6
Responded (n)	Yes	53.0	47.0	50.0	68.0	0.0	27.0	245.0
Missing		23.0	20.0	2.0	1.0	2.0	8.0	56.0
Not Applicable		0.0	0.0	0.0	0.0	0.0	0.0	0.0

Examples: Cost and Staffing Studies

Costing and Staffing a Minimum Package of Services

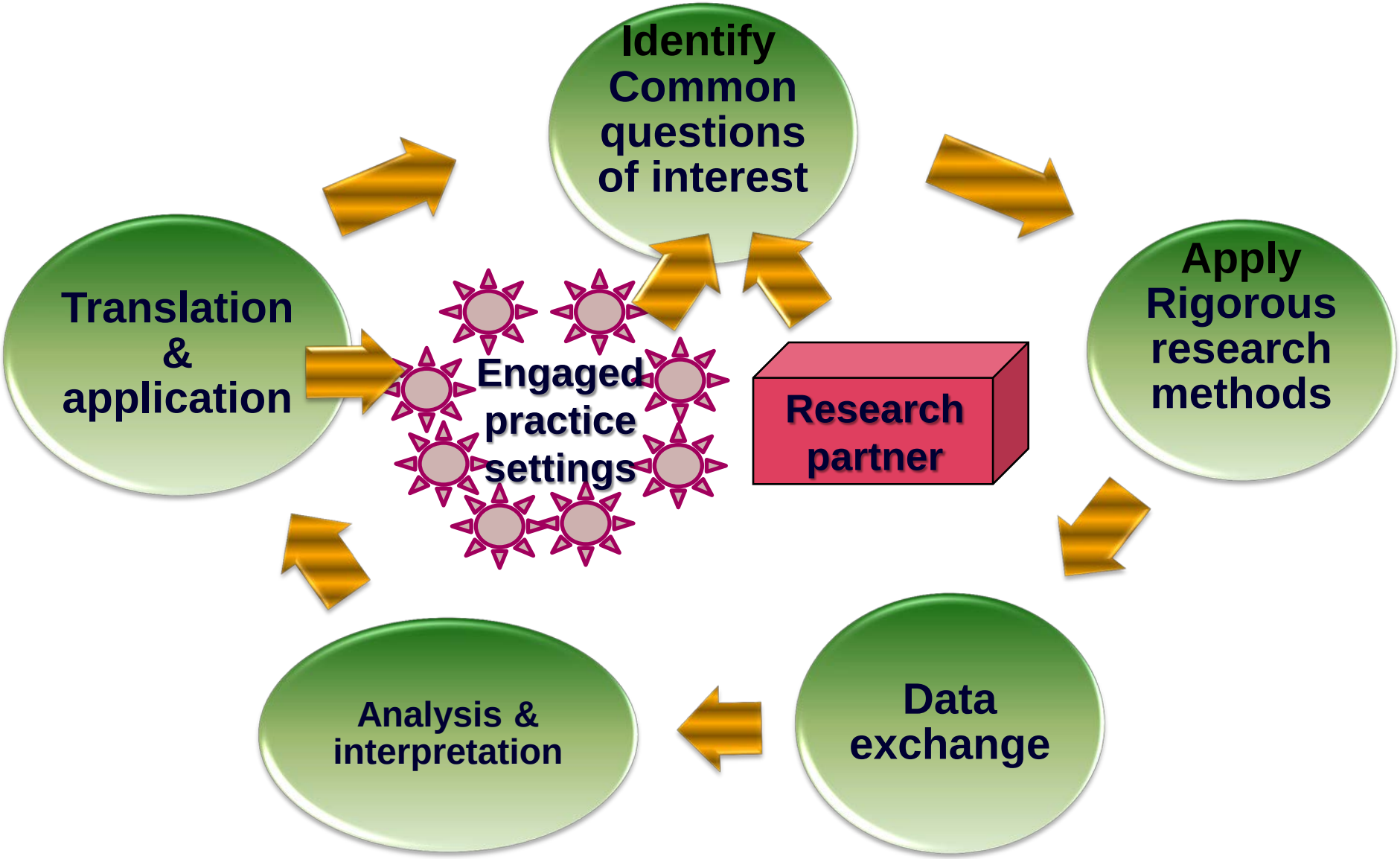
- ***Question of interest:*** What financial and human resources are required to deliver a core package of services for a defined population?
- ***Practice settings:*** Selected agencies from multiple PBRNs
- ***Factors examined:***
  - Labor costs and FTEs
  - Volume and intensity of service delivery
  - Direct and indirect costs
- ***Study design:*** observational, cross-sectional



Practice-Based Learning: Implications for STEM Education

- Relevant practice settings for STEM education
  - K12 Schools
  - Higher ed
  - Research institutions
  - Place-based settings (e.g. museums, parks)
- Evidence-based practices to study
  - Diffusion and Reach
  - Fidelity in implementation
  - Adaptation
  - Cost and value
- Innovations to evaluate

A PBRN for STEM Education?

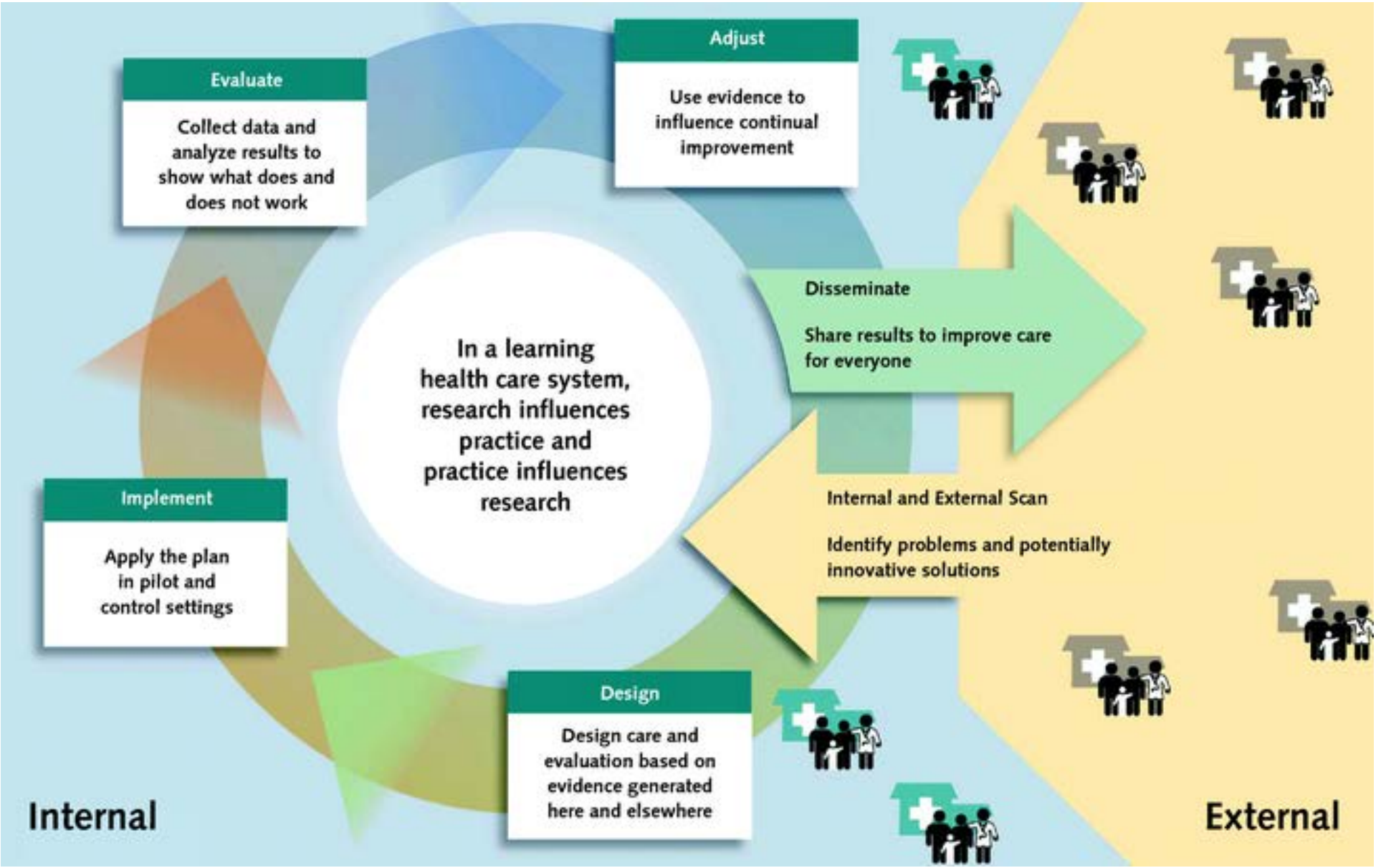


Conclusions: getting inside the box

- Engagement of practice and research partners
- Sensitive and specific measures
- Research designs in real-world settings

- What works best in which settings and why
- Informed practice decisions
- Smarter investments and greater value

Toward a “rapid-learning system” in STEM education?



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For More Information

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Supported by The Robert Wood Johnson Foundation

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